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SUPPLEMENT 201

A KEY TO SPECIES OF HELMINTHOSPORIUM REPORTED ON GRASSES IN THE UNITED STATES

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Plant Industry Station
Beltsville, Maryland

A KEY TO SPECIES OF HELMINTHOSPORIUM REPORTED ON GRASSES IN THE UNITED STATES

E. S. Luttrell

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A KEY TO SPECIES OF HELMINTHOSPORIUM REPORTED ON GRASSES IN THE UNITED STATES[1]

E. S. Luttrell

The purpose of the following key is to provide an index to the species of *Helminthosporium* found on grasses in the United States. Descriptions and a bibliography of the literature dealing with these species are available in Sprague's (1)[2] recently published book on diseases of cereals and grasses. Although at present a host index may afford the simplest means of identifying *Helminthosporium* species, a key based on the morphology of the fungus should be of practical value, especially in the determination of species on previously unreported hosts. This key is derived primarily from Drechsler's (2) detailed descriptions of the majority of the species with occasional reference to the more recent literature for emendations and for data concerning species reported since the publication of Drechsler's paper. It is based almost entirely on characteristics of the conidium since these characters may be utilized in the determination of material growing in culture as well as on the natural substrate. An attempt has been made to place primary emphasis on criteria which appear to be of major taxonomic importance. Consequently, the key may also serve in bringing together morphologically similar species and in emphasizing the relationships among them. The principal criteria employed are type of germination, shape, insertion of the hilum, wall thickness, color, diameter, length, and septation of the conidia. Often variations, especially in dimensions and color of the conidia, greater or lesser than those reported in the descriptions of species are found in individual collections, and the occurrence of morphologically distinct forms has been reported in several species. Consequently, difficulties in following the key are inevitable. These presently unavoidable imperfections in the key, however, should call attention to the type of data necessary for a satisfactory treatment of this group of fungi.

KEY TO SPECIES (3)

A. Conidia borne on sterigmata; perfect stage, when known, in *Leptosphaeria*.
The *H. sigmoideum* Group (4)

B. Producing large, spherical, black sclerotia 150-500 µ diam; conidia 29-49 x 10-14 µ, fusiform, curved, pointed at the ends, typically 3-septate, often constricted at the middle septum, intercalary cells brown, terminal cells greenish; causing leaf spot and culm rot of rice (*Oryza sativa* L.), also on *Echinochloa* and *Zizaniopsis*.
H. sigmoideum Cav.

B. Sclerotia irregular in shape, rough, smaller, 90-119 x 268-342 µ; conidia 41-58 x 9-12 u; less actively parasitic, on rice.
H. sigmoideum var. *irregulare*
Cralley & Tullis

A. Conidia sessile.

C. Conidia germinating from any or all cells, cylindric or subcylindric and tapering slightly toward the ends; perfect stage, when known, in *Pyrenophora* (= *Pleospora*).
The *H. gramineum* Group (Subgenus
Cylindro-Helminthosporium of
Nisikado, Genus *Drechslera* of Ito)

D. Conidia extremely large, typically over 300 µ long, 2-5 septate, in germination producing whorls of 3-4 thick germ tubes from slightly above the tip of the basal cell and slightly below the tip of the apical cell, occasionally producing germ tubes from intercalary cells, cylindrical, thin-walled, pale brown, 185-385 x 15-25 µ; causing zonate eye spot of Bermuda grass (*Cynodon dactylon* (L.) Pers.) and numerous other grasses.
H. giganteum Heald & Wolf (5)

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[1] Paper No. 210, Journal Series, Georgia Experiment Station.

[2] Numbers in parenthesis refer to Notes and References, page 65.

D. Conidia typically less than 300 μ long, 1-7-11-septate, not producing germ tubes in whorls.

E. Conidia dark olivaceous, thick-walled, cylindric or subcylindric and tapering slightly toward both ends, 25-140 x 11-25 μ (av. 83 x 19 μ), 1-12-septate (av. 6.3); causing leaf spot of bluegrass (*Poa pratensis* L.) and other species of *Poa*.

H. vagans Drechsl.

E. Conidia subhyaline to pale brown or pale brownish- or yellowish-olivaceous, thin-walled (wall moderately thick in *H. siccans*).

F. Basal cell of conidium tapering, rounded cone-shaped.

G. Conidia subhyaline, 45-175 x 12-21 μ, 1-9-septate; causing leaf blight of *Agropyron*, wheat (*Triticum aestivum* L.), rye (*Secale cereale* L.) and other grasses.

H. tritici-repentis Died.

G. Conidia yellowish-brown to pale yellowish-brown, 28-183 x 9-22 μ, 0-10-septate; causing yellow spot of leaves of wheat.

H. tritici-vulgaris Nisikado

F. Basal cell of conidium rounded, hemispherical to hemi-ellipsoidal.

H. Conidia usually subcylindric and tapering decidedly toward the ends, less commonly cylindric.

I. Subcylindric conidia often widest near the apex and tapering toward the base although commonly obclavate, wall moderately thick, subhyaline to yellowish- or brownish-olivaceous, 31-131 (-151) x 11-20 μ (av. 80 x 17 μ), 2-10-septate (av. 4.9); causing leaf blight of ryegrass (*Lolium* spp.)

H. siccans Drechsl. (6)

I. Subcylindric conidia consistently obclavate, widest near the base and tapering toward the apex, wall thin.

J. Conidia often terminating in a constricted, sparingly septate apical prolongation.

K. Apical prolongation often bearing a conidial scar indicating an *Alternaria*-like formation of secondary conidia; conidia 30-200 x 14-18 μ, 1-10-septate, subhyaline to pale yellowish; causing leaf blight of *Cinna* and Sudan grass (*Sorghum vulgare* var. *sudanensis* (Piper) Hitchc.)

H. catenarium Drechsl. (6)

K. Apical prolongation not bearing a conidial scar; conidia 53-135 x 15-23 μ, 1-11-septate, subhyaline to yellowish; on withered leaves of *Agrostis* and *Eleusine*.

H. stenacrum Drechsl. (6)

J. Conidia rounded at the apex, not terminating in a constricted prolongation, subhyaline to yellow or fuligenous, 21-121 (-161) x 11-20 μ (av. 75 x 16 μ), 1-11-septate (av. 4.4); causing netblotch of fescue (*Festuca* spp.).

H. dictyoides Drechsl. (6)

H. Conidia usually cylindric, less commonly subcylindric and tapering slightly toward the ends.

L. Maximum diameter of conidia 18-24 μ.

M. Conidia usually slightly constricted at the septa (especially the basal septum, this constriction producing a subglobose basal cell), subhyaline to greenish-fuligenous or yellow, 30-175 x 15-22 μ, 1-11-septate; causing netblotch of barley (*Hordeum vulgare* L.).
H. teres Sacc. (6)

M. Conidia usually not constricted at the septa.

N. Conidia of medium size, maximum length less than 200 μ.

O. Conidia 31-141 (-170) x 12-20 μ (av. 88 x 17 μ), 1-11-septate (av. 4.9), olivaceous to yellowish-brown; causing leaf blotch of oats (*Avena sativa* L.).
H. avenae Eidam (6)

O. Conidia 31-111 (-131) x 11-24 μ (av. 70 x 17 μ), 1-7-septate (av. 4.9), subhyaline to yellowish-brown; causing stripe of barley.
H. gramineum Rabh. (6)

N. Conidia large, maximum length over 200 μ (under moist conditions up to 400 μ), pale brown, 45-265 x 14-26 μ, 1-10-septate; causing leaf spot of brome grasses (*Bromus* spp.).
H. bromi Drechsl. (6)

L. Maximum diameter of conidia 16 μ; conidia yellowish to pale olivaceous, 21-105 x 8-16 μ (av. 65 x 12)μ, 2-10-septate (av. 5.4); causing leaf spot of *Agrostis*.
H. erythrospilum Drechsl. (6)

C. Conidia germinating by polar germ tubes, ellipsoid to fusoid; perfect stage, when known, in *Cochliobolus* (= *Ophiobolus*).
The *H. sativum* Group (Subgenus
Euhelminthosporium of Nisikado).

P. Conidia with protruding conical hilum.

Q. Basal cell or basal and apical cells of conidia frequently lighter in color and set off by accentuated, thicker, darker septa.

R. Apex of conidium often produced as a long, constricted, cylindrical rostrate extension; conidia 32-184 x 14-22 μ, 8-15-septate, dark olivaceous; causing leaf spot of *Eragrostis*, *Paspalum*, sorghum (*Sorghum vulgare* Pers.), corn (*Zea mays* L.), Sudan grass, pearl millet (*Pennisetum glaucum* (L.) R.Br.)
H. rostratum Drechsl.

R. Apex of conidium not rostrate.

S. Conidia 20-105 x 10-14 μ, 1-12-septate, brownish-yellow to dark olivaceous; mold and secondary seed and root rot of *Distichlis* and other grasses.
H. halodes Drechsl.

S. Conidia 23-72 x 13-20 μ (av. 52 x 16.5 μ) 2-9-septate (av. 6), light greenish-brown to smoky-brown; possibly occurring on roots of various grasses in the United States.
H. halodes var. *tritici* Mitra.

Q. Basal and apical cells of conidia concolorous with intercalary cells, not set off by accentuated septa.

T. Maximum diameter of conidia less than 20 µ, maximum length less than 100 µ; conidia subcylindric-fusoid to ellipsoid, straight or slightly curved, subhyaline to pale fuligenous with hyaline cone-shaped area around hilum, 28-92 x 10-18 µ, 3-9-septate; causing leaf blight of Paspalum.
H. micropus Drechsl.

T. Maximum diameter of conidia over 20 µ, maximum length over 100 µ.

U. Conidial wall thin; conidia subhyaline to pale fuligenous, later moderately fuligenous, greenish-yellow, yellowish-brown, or pale olive, 45-132 x 15-25 µ, 1-8-septate, fusoid, straight or slightly curved; causing leaf blight of corn, sorghum, Johnson grass (Sorghum halepense (L.) Pers.), Sudan grass.
H. turcicum Pass.

U. Conidial wall thick; conidia dark olivaceous, yellowish when young, 40-150 x 15-22 µ, 3-10-septate, fusoid, straight or curved (curvature often pronounced); causing spot blotch of Echinochloa.
H. monoceras Drechsl.

P. Conidia without protruding hilum; hilum included within the contour of the wall of the basal cell.

V. Conidia 1-6-septate.

W. Conidia yellowish, ellipsoid, often broader near the apex and tapering to the pointed base, frequently constricted at the basal septum, 18-48 x 8.5-14 µ, 2-6-septate; on withered leaves of Agrostis and Anthoxanthum.
H. dematioideum Bub. & Wrŏbl.

W. Conidia dark olivaceous to brown.

X. Maximum length of conidia more than 50 µ, maximum width less than 20 µ.

Y. Conidia ellipsoid to fusoid-obclavate (widest near the base), 15-67 x 11-17 µ, 1-6-septate, wall thick, dark olivaceous; on withered leaves of Eleusine and Eragrostis.
H. leucostylum Drechsl.
(= ? H. hadrotrichoides Ell. & Ev.)

Y. Conidia fusoid-clavate (widest near the apex), 22-78 x 12-19 µ, 1-5-septate, brown; causing false smut of Sporobolus.
H. ravenelli Curt.

X. Maximum length of conidia less than 50 µ, maximum width 20 µ or more.

Z. Conidia 20-41 x 10-20 µ, mostly 3-septate, dark olivaceous to brown, ellipsoid; producing long, simple or branched, pseudoparenchymatous stromata in culture; causing root rot of wheat.
H. tetramera McKinney (7)

Z. Conidia 35-50 x 15-21 µ, 2-3-septate, dark olivaceous, ellipsoid, wall thick; not producing stromata; mold of Agrostis and Dactylis.
H. triseptatum Dreschs. (7)

V. Conidia 1-7-13-septate

(a) Conidia dark olivaceous, wall thick.

(b) Basal cell of conidium prolonged as a cylindrical, pedicel-like protuberance; conidia broad-fusoid, typically straight, brownish-loive, hyaline at tip of

basal cell in area surrounding hilum, 31-91 x 15-29 µ (av. 65 x 23 µ), 1-9 septate (av. 7); isolated from roots of wheat.
H. pedicellatum A.W. Henry (Minnesota Agr. Expt. Sta. Tech. Bull. 22: 42, 1924).

(b) Basal cell of conidium not protuberant.

(c) Conidia usually straight.

(d) Hilum extremely large, conspicuous; producing columnar pseudoparenchymatous stromata bearing conidiophores toward the apex in culture; conidia subcylindric to fusoid or ellipsoid, dark olivaceous except in restricted subhyaline areas at the tips, 45-110 x 12-17 µ, 4-12-septate; causing leaf spot of *Danthonia*.
H. cyclops Drechsl.

(d) Hilum moderately conspicuous, not producing columnar stromata in culture.

(e) Maximum diameter of conidia less than 20 µ.

(f) Maximum diameter of conidia 14 µ; conidiophores arising from a tuberous erumpent stroma; conidia oblong, rarely subclavate, olivaceous, straight, thick-walled, 50-100 x 12-14 µ, 4-7-septate; on rotted culms of rye.
H. tuberosum Atk.

(f) Maximum diameter of conidia 17-18 µ; conidiophores not arising from a tuberous stroma.

(g) Conidia 25-103 x 7-18 µ (av. 63 x 13 µ), 2-12-septate (av.7), fusoid, straight, or slightly curved, dark olivaceous-brown; causing leaf spot and ear rot of corn.
H. carbonum Ullstrup (8)

(g) Conidia 33-115 x 10-17 µ, 3-11-septate-, fusoid, straight or slightly curved, olivaceous to black-olivaceous or chocolate brown; saprophytic on corn stalks.
H. zeicola Stout (8)

(e) Maximum diameter of conidia more than 20 µ; conidia 40-85 x 20-26 µ (av. 58 x 22 µ), 3-9-septate, fusiform, straight, dark olivaceous; causing rusty blotch of leaves of barley.
H. californicum Mackie & Paxton (8)

(c) Conidia usually curved.

(h) Maximum diameter of conidia 18 µ; conidia fusiform-obclavate to ellipsoid, usually curved, 40-120 x 10-18 µ, 5-10 septate, dark olivaceous, occasionally paler in the terminal cells, causing root rot and spot blotch of *Setaria*.
H. setariae Saw. (8)

(h) Maximum diameter of conidia 20 µ or more.

(i) Causing spot blotch and blight of cereals and grasses.

(j) Causing spot blotch and root rot of barley and numerous other grasses; conidia fusiform, typically curved, dark olivaceous; 60-120 x 15-20 µ, 3-10-septate.
H. sativum Pam., King, & Bakke (8)

(j) Causing blight of Victor Grain oats; conidia fusiform, slightly curved, fuligenous to dark olivaceous, 40-130 x 11-25 µ (av. 70 x 15 µ), 4-11-septate (av. 8).
H. victoriae Meehan & Murphy (8)

(i) Causing brown leaf stripe of sugarcane (*Saccharum officinarum* L.); conidia fusiform, typically curved, dark-olivaceous, 40-133 x 12-22 µ (av. 83 x 17 µ), 3-12-septate (av. 7.7).
H. stenospilum Drechsl. (8)

(a) Conidia fuligenous to brown, wall relatively thin.

(k) Conidia terminating in a long, slender, apical, flagellum-like process, ellipsoid, fuligenous, 70-150 µ long, 7-9-septate; on leaves of *Panicum*.
H. flagelloideum Atk.

(k) Conidia not terminating in a flagellum-like process.

(l) Maximum diameter of conidia less than 15 µ, maximum length less than 100 µ.

(m) Maximum diameter of conidia 11 µ; conidia obclavate, rounded at the base, tapering to the apex, straight or curved, fuligenous to dark fuligenous, 27-86 x 8-11 µ (av. 52 x 10 µ), 2-9-septate; causing leaf spot of buffalo grass (*Buchloë dactyloides* (Nutt.) Engelm.) and grama grasses (*Bouteloua* spp.)
H. buchloës Lefebvre & A.G. John.

(m) Maximum diameter of conidia 14 µ; conidia ellipsoid to fusoid.

(n) Germ tubes branching at some distance from the conidium; conidia 50-95 x 11-14 µ, 3-12-septate, ellipsoid, slightly curved, pale fuligenous; causing leaf spot of *Leersia*.
H. leersiae Atk.

(n) Germ tubes branching close to the conidium; conidia 27-80 x 11-14 µ, 3-9-septate, subcylindric-fusoid, straight or slightly curved; causing leaf spot of Bermuda grass, also on *Eleusine* and *Muhlenbergia*.
H. cynodontis Marig.

(l) Maximum diameter of conidia more than 17 µ, length more than 100 µ.

(o) Conidia up to 170 µ in length, fusiform, curved, fuligenous to brownish, 16-90 (-170) x 11-17 µ, 5-8-(13)-septate; causing leaf spot, culm and inflorescence damage, and seedling blight of rice.
H. oryzae V. Breda de Haan (9)

(o) Conidia not over 115 µ in length.

(p) Conidia yellow or pale olivaceous.

(q) Average number of conidial septa 7.7-8.3; conidia fusiform, curved, fuligenous to pale olivaceous, 25-127 x 7-21 µ, (av. 89 x 15 µ), 3-13-septate; causing leaf spot of corn.
H. maydis Nisik. & Miy. (9)

(q) Average number of conidial septa 5.1; conidia smaller, less strongly curved, fusiform, yellow to pale olivaceous, 20-105 x 8-20 µ (av. 59 x 14 µ), 2-8-septate; causing leaf spot of sorghum, Johnson grass, Sudan grass.
H. sorghicola Lefebvre & Sherwin (9)

(p) Conidia brown.

(r) Conidia 19-132 x 8-21 µ, 2-11-septate, fusiform, curved, pale to dark brown; causing eye spot of sugarcane, Napier grass (Pennisetum purpureum Schumach.), and lemon grass (Cymbopogon citratus (DC.) Stapf).
H. sacchari (V. Breda de Haan) Butler (9)

(r) Conidia 50-100 x 12-17 µ, 4-10-septate, fusiform, straight or curved and flattened on the inner side, brown; causing leaf spot and blight of Eleusine.
H. nodulosum (Berk. & Curt.) Sacc. (9)

Notes and References

1. Sprague, Roderick. Diseases of cereals and grasses in North America. New York. Ronald Press Co., 538 pp., 1950.

2. Drechsler, Charles. Some graminicolous species of Helminthosporium. Jour. Agr. Res. 24: 641-739. 1923.

3. According to the description by Saccardo (Syll. Fung. 4: 408, 1886), H. parvulum Cke., which was listed by Weiss (Index of Plant Diseases in the United States. U. S. D. A. Plant Dis. Survey Special Pub. No. 1, Part 3, p. 420, 1950), on pampas grass, is doubtfully a Helminthosporium species. Certainly the description, "conidia scattered, cylindrical, obtuse, 1-2-septate, straight, brown, 10-17 x 3.4 µ", is too incomplete to permit the inclusion of this species in the key. H. poae Baudýs, which was reported by Sprague (l.c. (1)) on species of Poa, likewise is inadequately described and is, therefore, omitted from the key. According to Saccardo (Syll. Fung. 25: 823, 1931) the conidia of H. poae are cylindrical, pale brown, 36-73 x 17-22 µ, and 2-6-septate with thick septa. Although H. flagelloideum and H. tuberosum apparently have not been reported in the United States since they were originally described by Atkinson (Bull. Cornell Univ. (Sci.) 3 (1), 50 pp., 1897) and are inadequately known, they are tentatively inserted in the key. The flagellum-like apical process of the conidium appears to be sufficient to distinguish H. flagelloideum from other species of Helminthosporium. However, the tuberous stromata which Atkinson described as the most important characteristic of H. tuberosum possibly represent immature perithecia on which conidiophores are produced, a type of development which occurs in H. teres also according to Drechsler (l.c. (2)). It is probable that the conidiophores of H. tuberosum normally arise directly from the leaf or stem surface; and, in this case, Atkinson's description offers little basis for distinguishing H. tuberosum from related species.

4. The single species and one variety in this group probably should be placed in a separate genus. H. sigmoideum is clearly distinct from other species of Helminthosporium on grasses in the production of sterigmata and falcate, acutely-pointed conidia.

5. Because of its peculiar type of germination and its production in culture of a Hormodendron-like stage from the hyphae or, by proliferation, from the conidia, Drechsler (Jour. Agr. Res. 37: 473-492, 1928) expressed doubt that H. giganteum should be included in the same series with other species placed in the Cylindro-Helminthosporium group. It is readily distinguishable from any other species of Helminthosporium on grasses.

6. H. siccans, H. catenarium, H. stenacrum, H. dictyoides, H. teres, H. avenae, H. gramineum, H. bromi, and H. erythrospilum represent a complex of similar species. H. vagans differs decidedly from these species in the thicker walls and deeper color of the conidia. H. tritici-repentis and H. tritici-vulgaris, two nearly identical species, are distinguished only by the peculiar shape of the basal cell of the conidium. It is uncertain whether the constricted apical prolongation, the character utilized in the separation of H. stenacrum and H. catenarium, is peculiar to these two species or whether it is an

aberration which may be induced in other species as well under certain environmental conditions. A proliferation to form secondary conidia similiar to that in *H. catenarium* has been reported in *H. sorghicola* by Lefebvre and Sherwin (Mycol. 40: 708-716, 1948) and in *H. gramineum*, *H. teres*, *H. cyclops*, and *H. sativum* by Drechsler (l.c. (2)). In spite of this peculiarity, therefore, *H. stenacrum* and *H. catenarium* appear to be closely related to the other species of the *H. gramineum* complex. Conidial shape appears to be a useful character in the separation of species in this complex, although differences can be expressed only as tendencies. In *H. dictyoides* expecially the consistently obclavate shape is a pronounced characteristic of the conidium. The moderately thick walls of fully mature conidia of *H. siccans* may assist in distinguishing this species. However, the walls often are not appreciably thicker than those of other species, and it is difficult to rely on this character. Constriction of the conidium, the character employed in the separation of *H. teres*, is of doubtful value since the constrictions in *H. teres* are slight and similiarly constricted conidia may occur in other species. Here again differences can be expressed only as tendencies. It may be necessary to depend principally on conidial dimensions and septation in the separation of species in this complex (Drechsler, Phytopath. 25: 344-361, 1935), but in view of the differences among races of *H. gramineum* reported by Christensen and Graham (Minnesota Agr. Expt. Sta. Tech. Bull. 95: 1-40, 1934) it is evident that more extensive data on variation within the species are necessary before such criteria can be used with confidence. The lesser diameter of the conidia of *H. erythrospilum* and the greater size of *H. bromi* conidia may be sufficient to distinguish these two species. It should be noted, however, that conidial dimensions of *H. avenae* as frequently reported (Sprague l.c. (1)) are similiar to those of *H. erythrospilum*, not exceeding 16 μ in diameter and hardly exceeding 100 μ in length. The larger dimensions for *H. avenae* given in the key are taken from Drechsler (Phytopath. 25: 344-361, 1935; l.c. (2)) who reported conidia of *H. avenae* as of approximately the same size as those of *H. teres* and clearly distinguishable by their greater diameter from those of *H. erythrospilum*.

7. *H. tetramera* and *H. triseptatum* are very close to the short-spored forms in the genus *Brachysporium*. If *Brachysporium* is to be maintained as a genus, it probably must be separated from *Helminthosporium* upon the basis of some arbitrarily selected conidial length/width ratio. Judging from the conidial dimensions of species included in *Brachysporium* by Saccardo (Syll. Fung. 4: 423-430, 1886) this ratio should be in the neighborhood of 3:1. On this basis *H. tetramera* and *H. triseptatum*, as well as some of the species placed in *Helminthosporium* by Saccardo himself, would fall in *Brachysporium*. However, it is doubtful that *Brachysporium* can be maintained as a separate genus. Drechsler (Jour. Agr. Res. 31: 701-726, 1925) suggested that many of the species in *Brachysporium* may be more closely related to species in the subgenus Euhelminthosporium than are the latter to species in the subgenus Cylindro-Helminthosporium.

8. *H. carbonum*, *H. zeicola*, *H. californicum*, *H. setariae*, *H. sativum*, *H. victoriae*, and *H. stenospilum* constitute a complex of closely related species, most of which are of doubtful validity. The separation of these species on the basis of curvature and diameter of the conidia is uncertain because of variations among different collections and strains within the species. The typically curved conidia of *H. sativum*, for example, may sometimes be predominantly straight; and in *H. californicum*, which Sprague (l.c. (1)) considered to be synonymous with *H. sativum*, they were described as being "not curved". Although *H. carbonum* is segregated with species in which the diameter of the conidia does not exceed 18 μ, Robles (Phytopath. 39: 1020-1028, 1949) reported the average dimensions of conidia of this species as 87 x 21 μ. Furthermore, he described, as "*Helminthosporium* Z", material from corn in which the conidia were 36-238 x 10-26 μ (av. 115 x 19 μ), 1-14-septate (av. 8), fusiform, usually slightly curved, and dark olivaceous brown. He believed that "*Helminthosporium* Z" might prove to be a form of *H. carbonum*. It seems probable that *H. carbonum* is a synonym of *H. zeicola*. The restricted parasitism of *H. carbonum* on certain recently developed inbred lines of corn might well indicate that it is a previously saprophytic fungus which adopted a parasitic habit when new hosts offering a more favorable substrate became available. It may be possible to distinguish *H. setariae* from *H. sativum* and *H. stenospilum* on the basis of its narrower conidia. However, Parris (Phytopath. 40: 90-103, 1950) reported the conidial dimensions of *H. stenospilum* as 52-133 x 10-16 μ (av. 85 x 14 μ), and these dimensions approximate those of *H. setariae*. *H. victoriae* apparently is only a physiologic race of *H. sativum*

and, along with *H. californicum*, probably should be reduced to synonomy with this species. This view is strengthened by Earhart's (Phytopath. 41: 11, 1951) report of a strain of *Helminthosporium* resembling *H. sativum* in some respects and *H. victoriae* in others and causing blight of an oat variety resistant to *H. victoriae*. Also, there is no evident morphological basis for the separation *H. stenospilum* from *H. sativum*.

9. *H. oryzae*, *H. maydis*, *H. sorghicola*, *H. sacchari*, and *H. nodulosum* are so closely related that they constitute hardly more than a group of physiologic forms of a single species. *H. buchloës* is distinguished from this group by the lesser dimensions and obclavate shape of its conidia. The nearly identical species *H. cynodontis* and *H. leersiae* are distinguished only by the smaller size of their conidia, and it should be noted that the conidial dimensions of some of the isolates of *H. sacchari* studied by Parris (Phytopath. 40: 90-103, 1950) fell within the range given for *H. cynodontis*. The difference in conidial length employed in the separation of *H. oryzae* is of doubtful value since, according to Drechsler (l.c. (2)), the larger conidia of this species are found only on the mats of hyphae covering the glumes of the host. A similiar development probably occurs in *H. maydis*. Drechsler (Jour. Agr. Res. 31: 701-726, 1925) described a fungus on moldy tassels of corn which he considered to be *H. maydis*, although the conidia were much longer than those of this species as they normally develop on leaves, measuring 28-155 x 10-17 μ. Differences in color as well as in extreme and mean dimensions and septation of the conidia in this group appear to be of questionable significance in view of the great variation reported by Parris (Phytopath. 32: 46-63, 1942; Ibid. 40: 90-103, 1950) in isolates of *H. sacchari*. He described forms in which the conidia varied from subhyaline through yellowish, fuligenous, or olive-green to dark brown, the latter approaching *H. stenospilum* in color. Drechsler (l.c. (2)) also reported the occurrence of dark olivaceous, thick-walled conidia in cultures of *H. oryzae*. Consequently, the distinction between the *H. oryzae* complex and the *H. sativum* complex is not as clear as might be desired. The criteria of color and especially wall thickness, however, are sufficient to distinguish typical forms of the two groups.

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